waterwise Queensland

The Inland Water Cycle Poster

Guideline for use

About the poster

The Inland Water Cycle poster (the poster) is part of the water cycle series and depicts a snapshot of Queensland's vast inland water system, including the extensive groundwater (underground) aquifers. The water journey illustrated in the poster is an outline of the natural water cycle and many elements of inland water storage and use. The setting represents a generic inland landscape to allow educators to identify and name local features to establish a familiar context relevant to their audience.

The department has produced two other educational posters—The Water Cycle (explaining the natural water cycle) and Total Water Cycle Management (explaining the water cycle in a coastal urban environment). These resources are available from the Department of Eenrgy and Water Supply (the department) website at ‹www.derm.qld.gov.au/waterwise›. The poster is also a useful resource for educators in coastal areas to assist in understanding the inland water cycle.

The poster aims to provide Queensland water educators and teachers with a resource to build learning about:

- the precious nature of water
- groundwater, including the Great Artesian Basin (GAB)
- water sources, supply and storage in inland urban and rural locations
- inland water use and reuse
- sustainable water management.

This guideline aims to assist water educators and teachers by offering suggestions and ideas for using the poster to stimulate inquiry. Curriculum links to the *Water: Learn it for Life!** resources are included.

* More information about *Water: Learn it for life!* can be found at: ‹www.derm.qld.gov.au/waterwise›

Contents

The poster is available free to Queensland councils and schools. It can be downloaded in PDF format for printing or copies can be ordered on the department's website at ‹www.derm.qld.gov.au/waterwise›.

Using the poster

General information

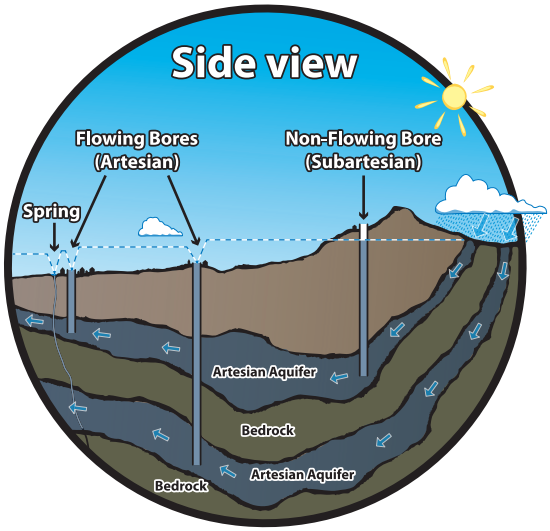
- Additional information and explanation of concepts presented in the poster, including the GAB, can be found in the Background Information for Teachers section of the *Water: Learn it for life!* resource.
- Familiarity with the processes of the natural water cycle introduced in The Water Cycle poster will aid audience understanding of the water cycle elements presented in this poster.
- Inland Queensland includes **Aboriginal heritage** places shaped by the original inhabitants and historical events of this landscape. Waterways, river systems and riparian zones are considered to be the lifeblood of Country for Aboriginal people. The Queensland Murray–Darling Committee (QMDC) Regional Caring for Country plan has significant information regarding Aboriginal people's relationship with inland landscapes. This plan is available from the publications section of the committee's website at ‹www.qmdc.org.au›.
- For older students it is important to explain that while the poster only shows water cycle processes occurring in specific areas, they are occurring throughout the entire landscape. **Transpiration** occurs from any vegetation, including grazing grasslands, and **evaporation** from any surface water. Surface water may be seeping (**infiltrating**) into the groundwater across the entire landscape, not just in the cut-away in the foreground.
- The poster shows evaporation followed by condensation then precipitation, all within a relatively small area on the landscape. In reality precipitation normally occurs a significant distance from the point of evaporation.
- In times of heavy rainfall, normally dry gullies and watercourses in the upper catchment fill to their capacity and excess water flows into rivers and creeks. When run-off is high rivers break their banks and flow over the land (**flooding** can be seen in the centre of the poster) sometimes meeting up with the river further along its journey. The term **'ephemeral'** is used to describe waterways that only flow for part of the year. These ephemeral waters subside leaving replenished wetlands, along with isolated bodies of water which form in-stream pools, billabongs and lagoons.
- Inland **wetlands** are diverse and productive areas where land and water meet. Wetlands can be swamps, lakes, rivers, billabongs and peat bogs—they do not have to be continuously wet. Lake Yamma Yamma on Cooper Creek in South West Queensland is often dry for years at a time. Water can flow into wetlands from rainfall, flooding, overland flow or groundwater seepage. Water is lost from the wetland through evaporation, seepage to groundwater or transpired through vegetation. Wetlands slow down and filter out nutrients and sediments from run-off that would usually go into creeks and rivers. They provide an important habitat and breeding place for a diversity of wildlife not found in other areas of Australia, including migrating waterbirds.
- The vegetation which lines natural waterways, called riparian vegetation, has many important functions. It acts to trap sediment carried in water flow and reduces the velocity of overland flood flows which enables sediments carried in the water to settle out. Riparian vegetation provides cooling shade for the waterway which creates a habitat for birds, fish and other wildlife and helps protect the waterway's banks from erosion during high water flow. Riparian vegetation should be retained along the full length of a watercourse in order to provide connectivity, wildlife corridors and a buffer against the impacts of earthworks and agriculture.
- The practice of damming a waterway ensures a more regular water supply in time of low rainfall. Dams can also act as a method of removing sedimentation from streams, as suspended solids in water flowing into the dam have time to settle out. Damming may affect local fish populations and other aquatic life. **Fishways** built into dam or weir walls allow upstream and sometimes downstream access for fish breeding and feeding.
- The scale of this poster does not allow detailed depiction of plant and animal life. Some of the plant and animal life that would be seen in a catchment such as this can be explored in the Flora and Fauna of the Murray–Darling Basin poster available from the publications section of the Murray–Darling Basin Association website ‹www.mdba.gov.au›.
- Operators of wastewater treatment plants are required to seek opportunities for beneficial reuse of treated wastewater where options exist. The wastewater treatment plant in the poster is positioned near both cropping and sporting fields, where irrigation would provide reuse options for treated wastewater (**recycled water**). Alternatively, treated wastewater may flow to a local waterway or become water vapour through evaporation or transpiration.
- Many inland residential properties may not be connected to a central wastewater treatment plant. Such properties are likely to have their own **septic**

system for wastewater instead, as seen in the left-hand foreground. Discharged wastewater that has been treated by a septic system may infiltrate into the ground or be taken up by plants through transpiration. In some communities a common effluent drainage scheme connects the septic systems to transport the discharge for further treatment.

- The two cropping paddocks either side of the wastewater treatment plant show **contour banks**, demonstrated by the regularly spaced brown lines. Contour banks are raised earth banks that follow the natural form of the land. Run-off containing both water and soil flows down the slope where the contour banks slow its speed and redirect its path to a drainage line or creek system, slowing the speed of the run-off and stopping it concentrating in gullies which reduces soil erosion. Modern cropping and grazing techniques that maximise vegetative cover to protect soil are also very important in preventing erosion.

Water sources

- For the purpose of illustrating an obvious cycle, the poster shows local evaporation, condensation and precipitation that reflects **convection rainfall**. In reality monsoonal or **frontal rains** are the main rain source for inland areas in northern Australia. Frontal rain is created when a mass of warm air meets a mass of colder air and rises. This cools the warm air creating condensation which forms clouds and then precipitation. Communities rely heavily on this rain to replenish surface water and recharge aquifers, ensuring continued water supplies. There will often be immediate growth of plants and greening of landscapes following rain and this can be seen in the poster with a slight green tinge where the precipitation has already passed as it moves forward from the horizon line.
- **Relief rainfall** (orographic rainfall) is the third source of rain and occurs when warm air is forced to rise over land features such as hills or mountains. The cooling effect of this rising air mass creates rain as described above. Relief rain can be seen in the side view section of the poster.
- Water infiltrates from surface flow and is carried down by gravity and capillarity to fill the tiny spaces between the soil particles (**infiltration**). If there is sufficient water available infiltration occurs until the ground becomes saturated, often to a considerable depth. Where water meets impervious rock, labelled as **bedrock** on the poster, it moves sideways until all tiny spaces are saturated. The layer filled with water is called the saturated zone and the top of this layer of saturation is referred to as the **water table**.
- Groundwater and surface water are linked systems—they are interdependent. Surface water can infiltrate past the plant root zone to become groundwater. This interaction is a two-way process. Groundwater may once again become surface water via springs and alluvial water may replenish streams if the water table is above the level of water in stream beds.
- Within Australia's Aboriginal cultural heritage, the journey of water from underground to surface springs or watering holes is depicted as an oral history of creation by the dreamtime story of the Rainbow Serpent.
- An aquifer is a deposit of permeable rock layers or sediments that transmit groundwater freely. Not all groundwater will yield a useable supply. **Alluvial aquifers** are areas of water-bearing sand and gravel typically deposited by lakes, streams and rivers.
- The penetration of water from alluvial aquifers to deeper underground can continue through porous rock formations like sandstone layers, or through cracks in rocks. Porous rocks store water and allow it to flow underground. Movement of water underground can be very slow.



- The term **'artesian'** refers to a confined aquifer in which the stored water is under pressure due to the relative height of the entry point of water into the aquifer (known as the **recharge area**). As can be seen in the illustration above, the artesian aquifers are confined by the layers of bedrock above and below them. The pressure of water higher up in the artesian aquifer pushes water through the system, in some cases to return to the surface. Springs are natural exit points for artesian aquifers. A bore sunk in an artesian basin results in water flowing freely to the surface.
- Subartesian water is not under sufficient pressure to bring it to the surface on its own and will require pumping to reach the surface.

The Great Artesian Basin

- The Great Artesian Basin (GAB) is a multi-layered **series** of confined aquifers; it is not a single aquifer. Within the GAB, layers of porous sandstone are sandwiched between bedrock layers of mudstone and siltstone. Water enters the GAB initially in recharge areas and then infiltrates very slowly (often for hundreds of kilometres) through the sandstone by the pressure of gravity. Much of the water in the GAB is thought to have entered the basin millions of years ago.
- It is important to recognise that while the majority of inland Queensland sits above the GAB there is a significant land mass in the upper half of the far western part of the state where this is not the case. See page 12 of the Background Information for Teachers section of *Water: Learn it for life!*
- The height to which water in an artesian aquifer will rise on its own is known as the **'potentiometric surface'**. In the side view section of the poster the potentiometric surface is indicated by the blue and white dotted line. As depicted in the diagram, the potentiometric surface decreases very slightly with each spring or bore as a small amount of the pressure within the aquifer is released. Since European settlement, the potentiometric surface in many areas of the GAB has reduced significantly due to the high number of open, free flowing bores that have been sunk. This pressure drop has resulted in the drying up of some previously flowing springs.
- The water supply of the Great Artesian Basin allowed early settlers access to artesian water. Bores were sunk and open drains channelled the water for tens of kilometres to water stock. This resulted in waste through seepage and evaporation. With funding from the Great Artesian Basin Sustainability Initiative (GABSI), open bores are gradually being capped and piped water systems are being built to distribute water. This initiative is reducing water wastage and significantly improving artesian pressure. As a result, springs in some areas have begun to flow again.
- The GAB has an average depth of 500 metres but is up to 3000 metres deep in some places. Water at a great depth in the GAB will often come to the surface hot. Heat from the earth's molten core is transferred through the bedrock which in turn heats the deep aquifer water. GAB water often requires cooling before use.
- In the past hot artesian water was pumped into a pond to cool creating water loss through evaporation and seepage (infiltration). Today, **artesian cooling dams** are used—the hot water enters copper piping arranged in a grid formation under the surface of the dam. This works like a radiator, allowing the hot water in the pipes to be cooled by the surrounding dam water. Therefore, no water is lost to evaporation or seepage and the natural artesian pressure is maintained, removing the need for pumping.

Image 1: A cooling dam prior to being filled with water

- In many of Queensland's inland areas the GAB is the only reliable supply of water for domestic, stock and irrigation purposes. Different areas of the GAB have varying levels of **water quality**. Artesian water is often of high quality due to lengthy underground filtering processes. Some is of sufficient quality that it may not require any treatment at all, or treatment by basic chlorination only, before distribution for drinking. **Chlorination** helps maintain water quality during distribution in piping networks. In some communities, high salinity may mean that groundwater supplies require desalination through reverse osmosis technology in order to provide a suitable drinking water supply. Without this treatment the salinity may make GAB water unsuitable even for irrigation purposes. In other areas GAB water may be mixed with a surface water supply prior to treatment.
- The GAB provides a source for spring wetlands (or **mound springs**) which occur naturally in the landscape where groundwater escapes to the surface under pressure. Some springs occur in rivers or creeks—termed watercourse springs—and add to stream-flow.

Water use

- Isolated springs appear on the landscape (upper left quadrant) and have long provided water for **Aboriginal people** who have extensive knowledge of the groundwater system. For thousands of years Aboriginal people have survived desert and semi-arid conditions by managing water sustainably. They have channelled and filtered their water and covered stored water to prevent contamination and evaporation. They are also adept at reading signs of water. For example, gum trees, dingo and ant movement are all signs of a water source. The Background Information for Teachers section of *Water: Learn it for life!* provides more detail.

- European settlers often followed the walking tracks of Aboriginal people because their tracks were an indication of water supply. Many of these tracks are marked in a way that reflects Aboriginal culture including painted and engraved (petroglyph) rock art, burials, pathways, scarred trees, stone artefacts and scatters, wells, grinding grooves and food and fibre resource sites. There are some Queensland GAB sites where archaeologists have found Aboriginal sites dating back 20 000 years.
- Dams and weirs are generally less efficient forms of mass water storage in inland areas of Queensland. Low humidity, high temperatures and usually shallow depth lead to high water loss through evaporation.
- **Ring tanks**, such as the one shown on the cotton farm in the right foreground of the poster, only pump water from streams for storage when a nominated level of flow is exceeded in the stream.
- Crops like cotton require large quantities of water resulting in **deep drainage** problems from irrigation as seen in the area below the cotton farm in the right foreground. Deep drainage occurs when irrigation water infiltrates below the root zone of the plants. As the water moves down it may pick up salts, nutrients and pesticides which have the potential to contaminate other groundwater sources. Information can be sourced from the department's website at ‹www.derm.qld.gov.au›.
- Groundwater below the cotton farm shows it is moving through the landscape. With the interdependence between groundwater and surface water, it is important to recognise that impacts on surface water quality in one area can lead to impacts on both groundwater and surface water in another area.
- Many communities are settled close to a river and are built at a height that reduces the likelihood of flooding during significant rainfall. Alternatively, many inland towns like Charleville are protected by **levee banks** built to guard the town from floodwaters which originate further upstream.
- Inland urban areas have a diverse array of **water supply sources**. Some communities use treated artesian or alluvial water for drinking water supply, while others use these sources untreated for toilets, showering or outdoor use (such as irrigation). Surface water storages may provide a source of drinking water for some towns, while elsewhere there may be no such source or it may only be used outdoors. Rainwater tanks are also an important water source with varying applications depending on the area. In some communities a combination of all water sources are used. Use and **treatment of water** in inland urban areas is dependant on the quantity and quality of water available. The poster shows all these sources to allow educators to discuss those relevant to their area.
- Coal mining is one of the many industries which depend on a plentiful supply of water. Coal and vehicle wash down and dust suppression are essential to prevent potentially explosive reactions from coal dust. Many mines use recycled water for a significant proportion of their use. Mining in the Bowen Basin, located in Central Queensland and running from Collinsville to Theodore, aims to use 60 per cent of water from recycled sources. Some mines generate an unwanted by-product from processing the ore, called tailings, which can be collected in a tailings dam. Groundwater can be pumped into the tailings dam which then evaporates or discharges to a local waterway.
- The emerging coal seam gas (CSG) industry in parts of inland Queensland is likely to play a significant role in the inland water cycle in the future. CSG is a natural gas, consisting primarily of methane, which collects in underground coal seams by bonding to the surface of coal particles. CSG is extracted through wells drilled into coal seams which are generally filled with water. The initial phase of CSG production usually involves the extraction of water from the coal seams in order to reduce the water pressure and release gas from the coal. Significant quantities of CSG water are likely to be generated as a result of CSG production. More information about CSG can be found on the department's website at ‹www.derm.qld.gov.au›.

Sustainability of inland water

- The **interdependence** of groundwater and surface water systems means that all water sources must be treated with respect and used efficiently, regardless of the perception of how much water may exist. Even if a plentiful water supply does exist there is a significant cost and carbon impact from both pumping and treating water.
- The complicated network of groundwater systems provide life to so much of inland Queensland. While the GAB provides a vast source of water, like any water system, overuse and wastage may have unforseen impacts in the future. As already discussed, the reduction in potentiometric surface as a result of high numbers of open bores in the GAB is a key example of this.
- 'Sustainability is concerned with the ongoing capacity of the Earth to maintain life. It aims to reduce our ecological footprint while simultaneously supporting a quality of life that is valued—the liveability of our society. Sustainable patterns of living meet the needs of the present without compromising the ability of future generations to

meet their own needs[1].' Before European settlement Aboriginal people managed water for thousands of years, providing models of sustainability.

- Water resource plans set a balance between providing water for irrigation and other consumptive uses, and reserving it for environmental flows. There are water resource plans for all major inland catchments, and the GAB. These plans are developed with input from the community and scientific experts. More information about water resource plans can be found on the department's website at ‹www.derm.qld.gov.au›.

Curriculum links

A water cycle poster is an abstract representation of reality. Usually it is preferable to introduce students to the concrete reality of the water cycle in the local area before introducing the poster. Make sure to explicitly link discussion about different elements of the poster to the students' own experiences.

The following are suggestions for linking the poster with activities contained in the *Water: Learn it for Life!* curriculum resource.

Learning overview—Active learning processes: investigating environments

As an example of how the poster could be integrated into a number of possible learning overviews, it is suggested that as a part of investigating environments the poster could be provided to groups of prep students. Students could explore the content of the poster to look for water sources.

Mini Inquiry 1—Why is water unique?

1.2.1 Students are introduced to the water cycle through *Whizzy's Incredible Journeys—Pick-a-Path book*. The poster could be introduced at the end of the reading to further explore the water cycle concept and set a context, if relevant, to the local inland area.

Mini Inquiry 2—Where do we find water?

2.3 Students explore where they might find water in the local area. The poster provides additional stimulus for students to reinforce concepts relevant to inland communities.

Unit 1—Lesson 3: Rain, rain

As part of this lesson explores groundwater the poster could be introduced as a visual aid to explain the concept of groundwater. This will assist students to understand that groundwater comes to the surface naturally to form springs and in other cases flows back into rivers.

Unit 1—Lesson 5: My water story

The poster could act as additional stimuli to assist students to create a storyboard of the local water story.

Unit 2—Lesson 1: Giving water use the slip

In this lesson students are introduced to the water cycle through *Whizzy's Incredible Journeys—Pick-a-Path book*. The poster could be introduced at the end of the reading to reinforce the concepts of the water cycle and set a local context.

Unit 2—Lesson 4: Poster talk

Students evaluate various posters to discover their key features and how they can be used. The poster can be used as an example that uses a local setting to create the context. There should be an emphasis on the different components and how the poster communicates its messages.

Unit 2—Lesson 5: Water expert training session

Students explore the various aspects of water through workstation activities, for example, how water travels through plants (workstation 3) and the water cycle (workstation 4). Display the poster in a prominent position for reference during these activities.

Unit 1—Lesson 2: Going on a water wander

In this lesson students undertake a field trip to view local water infrastructure. The poster could be used prior to this lesson to identify relevant infrastructure in the local area and to assist students in deciding on a relevant site to visit.

Unit 1—Lesson 4: Catchment catch-up

In this lesson students are presented with a map of their local catchment. The poster might first be used to introduce the idea of a catchment and can be discussed at a more general level. The poster is a powerful visual resource to improve student's conceptual development of groundwater within catchments. Maps of the local catchment may be found through the Wetlands*Info* website at ‹www.epa.qld.gov.au/wetlandinfo›.

Unit 2—Lesson 1: Making a statement

Students begin this unit by exploring what they already know about water. They are shown 13 water statements and asked whether they are true or false. Using The Inland Water Cycle as a visual aid for the class debrief will help students to stimulate their own ideas about water.

Unit 2—Lesson 4: The resource race

In this lesson students explore in a game situation the challenges of sharing a limited water resource among different water users. The poster could be used in either setting up or debriefing this activity to help identify different water users. Alternatively, after playing the resource race initially, students could then design their own inland resource race using the poster to generate ideas.

[1] The Australian Curriculum can be accessed at ‹www.australiancurriculum.edu.au

Unit 1—Lesson 1: Water—precious resource.

In the second session of the lesson students consider how Indigenous people find water in areas where it is scarce. The poster provides an opportunity for students to identify water sources in such areas.

Local community elders could be invited to provide perspectives on how local Indigenous people find and use water. For protocols explaining how the visit should be organised, go to page 22 of Embedding Aboriginal and Torres Strait Islander Perspectives in Schools. This publication can be found in the Education Services section of the Indigenous Education pages on the Education Queensland website at ‹http://education.qld.gov.au/schools/indigenous/›.

Unit 1—Lessons 3 and 4: Water journeys through our town—Parts 1 and 2

Students living in smaller rural communities have the opportunity to identify local water sources and carry out an audit of water use in their homes. They investigate sources and destinations of water moving through the local catchment and distinguish between groundwater and surface water. They also investigate the main features of water supply and distribution in the local area. Use the poster to demonstrate how water flows through the community, where water comes from, how it is used and stored and where it goes when it leaves the home. Point out the groundwater and surface water supplies. Highlight that in most cases groundwater and surface water both need to be treated to be safe for human consumption. Rural use of water for irrigation can come from bores, rivers and dams. Groundwater may need to be cooled before it can be used.

Unit 1—Lesson 5: Exploring your catchment

In this lesson students learn about the local catchment. The poster demonstrates that a catchment for inland water is quite different to coastal catchments. The Water Cycle or Total Water Cycle Management posters may be used to contrast.

Unit 1—Lesson 6: Catchments and water cycles

In this lesson students learn about the water cycle particularly as it applies to the local catchment. They explore and outline the processes of the natural water cycle and the water cycle with human impacts in the local community. Ask them to identify human impacts on the water cycle. Refer to the poster as a visual aid to facilitate this.

Unit 2—Lesson 2: Where does our drinking water come from?

Use the poster to help students identify the source of local water. If groundwater is a major source of water for the local community, initiate a discussion about the quality of the water. Is it safe to drink?

Unit 2—Lesson 4: Water in my catchment

Students focus on the catchment that supplies local water. The impacts of various local land uses on drinking water supplies are identified. Uses of groundwater are also explored within the context of the local community. The poster could be used to identify elements which need to be considered. For example start and end points of waterways, dams and drinking water supplies, urban areas, local sites and landmarks, underground water extraction and natural features such as billabongs, springs and mountains.

Unit 2—Lesson 6: Filtering groundwater and Lesson 7: Making water drinkable—Water treatment

In these lessons students explore the stages that occur in a water treatment plant and identify a number of ways to make water drinkable. Using the poster in addition to the Total Water Cycle Management poster, point out what happens to groundwater, drinking water treatment plants, the process of treatment of wastewater, where the water comes from and where it ends up.

Classroom activities

The following activities are designed for use with the poster. Activity selection should be based on the age and needs of the student group. Activities are sequenced in order of complexity.

1. Using The Water Cycle poster as an example, students draw pictures of Whizzy the waterdrop in the various processes of the water cycle on their own A3 or A4 size copy of this poster.
2. In a classroom discussion, students identify all the aspects of the poster that are familiar from their own local area. This could be recorded on a piece of butcher paper. From their own experience, some students may be able to explain in more detail the role certain features have in the water cycle for their local area.
3. Students identify as many water sources and uses as possible. A Think-Pair-Share strategy can be used to encourage students to be observant and contribute to an extensive class generated list.
4. The poster only labels evaporation and transpiration coming from some of the possible sources. Get students to identify all the possible areas where transpiration or evaporation may occur.
5. Students create a musical water story. As a class or in small groups identify different instruments (impromptu or traditional) to create sounds that reflect the different processes of the inland water cycle as set out in the poster. They could be recorded and possibly added to images in a simple PowerPoint for a class water movie.

6. Using words from both posters, students pick a word out of a hat and explain what that word means using the poster and/or Whizzy the waterdrop.
7. Students identify a particular water source—for example, lake, wetlands or groundwater—and research the life it supports.
8. Segment the poster as a jigsaw and have groups of students research different sections. A jigsaw learning strategy could be used if you want students to assimilate a lot of information about the inland water cycle relatively quickly. Create groups with the same number of students as the number of jigsaw pieces to form home groups. Number the jigsaw pieces of the poster and then number each student in each home group. Students from different home groups with the same number are assigned to work together in expert groups to analyse the corresponding jigsaw piece. They collate the information for the assigned jigsaw piece and then report back to their home group.
9. A fishway is depicted in the dam. Provide a quick background about fishways and their purpose to the students. Students set about designing a fishway that would allow the passage of fish up the river through a weir or dam, while maintaining the water storage ability of the weir or dam. A technology of design approach can be applied to this activity. For more information about this approach see Water: Learn it for life! Years 6-7—Lesson 8, page 34. An adaptation of the design process in Resource 8 could be used.
10. Students research all the different sources of water found in inland areas. The list could be organised into a table showing origin, uses, salinity and associated plant and animal life. This could be extended into an activity where students identify the most appropriate water source for a range of different water uses.
11. Students identify any of the features on the poster that have been designed with a water saving focus. Students apply this thinking to identify opportunities where water could be saved, for example by using different irrigation or water storage types.
12. As a class, develop a scientific explanation that describes the underground journey of water in the inland water cycle.
13. Overlay a grid on the poster to teach students the use of grid references. This can easily be done if the poster is laminated. Students practice finding what is located at various grid references and writing the grid references on the poster for each location.
14. Pose the following question as a classroom discussion starter—What should the water in the small dam above the left-hand cropping paddock be used for? Use this initial lead-in to facilitate detailed classroom discussion about appropriate use of the land in this area and the factors that will affect what is appropriate use.
15. Students use the poster as a stimulus for writing their own creative story about the journey of a water droplet. Older students could record readings of their stories and scan in illustrations for a simple slideshow for younger learners. This story could form the basis for a tour guide role-play scenario. For example, students take the rest of the class on a guided virtual tour of all the places that water from one source may possibly travel.
16. Students design a Stygofauna organism (an organism that lives in a groundwater system). This would include a rationale of the design. Students write an adventure for this organism.
17. Undertake an investigation into septic tanks; where they are used and how they work. For older students this may extend to include the advantages and disadvantages of this system compared to a centralised system for wastewater collection and treatment.
18. Students research where water comes from in their area and identify features from the poster that may be found in their local area. This could be used as the basis for groups of students to develop their own Total Water Cycle Management style poster that reflects their local area.
19. Students research aspects of science, engineering and technology within careers related to the provision of water for inland communities.
20. Compare and contrast the sources and use of water between the poster and the Total Water Cycle Management poster. Students could use a Venn diagram (set diagram) to assist them with this, indicating the similarities and differences between the two posters.

More information

Visit the Department of Environment and Resource Management website ‹www.derm.qld.gov.au/waterwise›.

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